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MICROCHIP FOR ANALYSIS

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MICROCHIP FOR ANALYSIS

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Claim

A microchip for analysis characterized in that it is a microchip for analysis in which a pair of plate-like members are provided, a recess for a fluid to flow is created on the surface of at least one of the plate-like members, a through hole is created on the other plate-like member at the position corresponding to said recess, and said plate-like members are pasted together while the aforementioned recess is facing inward in order to form an analysis flow path using said recess; wherein, said microchip is equipped with a storage means for recording attributes of the microchip and the history of its use and a means for external communication.

Detailed explanation of the invention

[0001]

Industrial application field

The present invention pertains to a microchip for analysis in which 2 plate-like members are pasted together while creating an analysis flow path therein in order to analyze a extremely small amount of sample at an ultra-fast speed and high separability.

[0002]

Prior art

In recent years, chips for analysis (will be referred to as microchips) created by combining 2 substrates are suggested as a means for achieving a quicker analysis and downsizing of a device which would replace a fused silica capillary which is troublesome to handle. An example microchip for electrophoresis is shown in Figure 2. It comprises a pair of transparent substrates (usually, glass, quartz, or resin are used) 31 and 32; wherein, capillary recesses 33 and 34 for migration are created on the surface of one of the substrates 31, and reservoirs 35 serving as through holes are created on the other substrate 32 at the positions corresponding to the ends of recesses 33 and 34.

[0003]

When using said microchip, substrates 31 and 32 are placed overlaid as shown in (C), and migratory solution is injected into recesses 33 and 34 from one of reservoirs 35. Then, a sample is injected into reservoir 35 on one side of shorter recess 34, and a high voltage is applied between reservoirs 35 on either side of said recess 34. As a result, the sample is dispersed into recess 34. Next, an electrophoresis voltage is applied to reservoirs 35 on either side of longer recess 33. As a result, the sample located at intersection 36 of recesses 34 and 35 electrophoreses in recess 33. A detector is provided at an appropriate position on recess 33 in order to detect the isolated sample which is carried in by electrophoresis in sequence.

[0004]

For the electrophoresis analysis, electrophoresis conditions can be changed by filling the electrophoresis recesses with a gel of various kinds, such as a acrylic amide gel and an agarose, and using an electrolyte of various kinds in order to handle the analysis of a sample of various kinds. In addition, analysis conditions can be changed in a variety of manners; for example, different molecular filtering effects can be achieved depending on the degree of crosslinking of the gel of various kinds, and the electro-osmosis flow can be regulated depending on the concentration of the electrolyte.

[0005]

In addition, in the case of an electrochromatographic analysis, particles of various kinds of materials, such as silica particles and polymer particles, are filled in columns, and the particles of the respective materials have fine holes of various sizes, and the surface is decorated with various kinds of functional groups. Of which, a column which is suitable for the isolation of a given sample to be analyzed is selected arbitrarily. In the case of a gas chromatographic analysis, the interiors of the columns are coated with various kinds of stationary solid phases, and a column which is suitable for the isolation of a given sample to be analyzed is selected arbitrarily.

[0006]

Problem to be solved by the invention

As described above, because there are many microchips to be used for analysis in order to change analysis conditions, a selection is made among microchips specialized for various kinds of functions. In addition, the use history needs to be kept in order to predict the service life of each microchip. Conventionally, a method in which model names are inscribed on respective chips to make them identifiable, and the information is recorded externally has been adopted in order to manage attributes of respective microchips and information on the history of use. However, when the management information is recorded externally, thorough management and automation of the management were difficult to achieve, resulting in a problem that management mistakes, such as misidentification of a microchip, were likely to occur.

[0007]

The present invention was made to solve this kind of problems, and its purpose is to present a microchip by which an analyzer can identify and select a microchip for analysis automatically, and reliable information management can be realized, that is, misidentification of a chip and a failure to renew the management information are eliminated.

[0008]

Means to solve the problem

In order to solve the aforementioned problem, the microchip of the present invention is a microchip for analysis in which a pair of plate-like members are provided, a recess for a fluid to flow is created on the surface of at least one of the plate-like members, a through-hole is created on the other plate-like member at the position corresponding to said recess, and said plate-like members are pasted together while the aforementioned recess is facing inward in order to form an analysis flow path using said recess; wherein, the microchip is equipped with a storage means

for recording attributes of the microchip and the history of its use and a function for external communication using a wired or a radio communication means.

[0009]

In the case of an electrophoresis analysis, information on the attributes of the microchip, such as the type and the degree of crosslinking of the gel filled in the electrophoresis recesses of the microchip for electrophoresis and the type of the electrolyte serving as a migratory solution, and information on the history of its use can be stored in the memory mounted on the microchip, and said information can be transmitted to the electrophoresis analyzer on which it is used. As a result, the electrophoresis analyzer can identify and select the microchip automatically, so that management mistakes, such as misidentification of a chip and a failure to renew the management information, can be eliminated. Furthermore, when the same microchip is to be used for multiple devices, because the management information travels with the microchip, it can be managed continuously and reliably.

[0010]

Embodiment

An embodiment of the present invention will be explained below based on the figures. Figure 1 [A and B] are diagrams showing the outline configuration of an application example in which the present invention is applied to microchip for electrophoresis. Said microchip for electrophoresis comprises a pair of transparent quartz substrates 1 and 2; wherein, crisscrossed capillary recesses 3 and 4 for migration are created on the surface of one of transparent quartz substrate 1, and reservoirs 5 and 6 and reservoirs 7 and 8 are provided at the positions corresponding to the ends of recess 3 for electrophoresis and at the positions corresponding to the ends of recess 4 for electrophoresis, respectively, on the surface of the other transparent quartz substrate 2. Furthermore, transparent quartz substrate 2 is provided with connectors 11 and 12 connected to reservoirs 5 and 6, connectors 13 and 14 connected to reservoirs 7 and 8, EEPROM (electrically erasable nonvolatile ROM) 20, connector 21 connected to +Vcc terminal of the EEPROM, connector 22 connected to I/O terminal of the EEPROM, and connector 23 connected to GND terminal of the EEPROM.

[0011]

In the case of the microchip for electrophoresis with the aforementioned configuration, transparent substrates 1 and 2 are placed overlaid, and the electrophoresis analysis is carried out according to the following procedures. First, after a migratory solution is injected into capillary recesses 3 and 4 from one of the reservoirs, a sample is injected into reservoir 7 provided on one

side of capillary recess 4, and a high voltage is applied between reservoirs 7 and 8 for a prescribed amount of time via connectors 13 and 14. As a result, the sample is dispersed into capillary recess 4. Next, an electrophoresis voltage is applied between reservoirs 5 and 6 provided on either end of capillary recess 3 via connectors 11 and 12. As a result, the sample present at intersection 9 of capillary recesses 3 and 4 electrophoreses in capillary recess 3. A detector is provided at an appropriate position on recess 3 in order to detect the isolated sample which is carried in by electrophoresis in sequence.

[0012]

EEPROM 20 provided on transparent substrate 2 is designed as such that it can be connected to the electrophoresis device via connectors 21, 22, and 23 in order to exchange the information stored in EEPROM 20. Chip types, chip production numbers, history of use, user names, and so forth may be mentioned as information stored in EEPROM 20. Types of gel filled in the migration recesses, types of electrolyte used as a migrating fluid, presence/absence of coating, and so forth are recorded under chip types; and the number of analyses performed, time spent for analyses, maximum voltage applied, and so forth are recorded under history of use. The information stored in EEPROM 20 is transmitted to the electrophoresis device via connectors 21, 22, and 23; and after the electrophoresis microchip concerned is confirmed to be suitable for the intended analysis, it is used for the electrophoresis analysis. In addition, after its use is finished, analysis conditions, the number of analyses performed, and so forth are newly stored into EEPROM 20 as the history of use.

[0013]

Because the memory, that is, EEPROM 20, and connectors 21, 22, and 23 for external access of the microchip are provided on the microchip for electrophoresis, information regarding the attributes of the microchip, for example, type and the degree of crosslinking of the gel filled in capillary recesses 3 and 4 of the microchip and the type of the electrolyte used for the migrating fluid, and the history of its use can be stored in EEPROM 20 mounted on the microchip; and the information can be transmitted further to the electrophoresis analyzer. As a result, the microchip can be identified and selected automatically by the analyzer, and misidentification of the chip and a failure to renew the management information can be eliminated. Furthermore, when the same microchip is used for multiple devices, because the management information travels with the microchip, it can be managed continuously and reliably.

[0014]

Although communication with the electrophoresis analyzer was achieved via connectors 21, 22, and 23 in the aforementioned application example, the communication may be achieved by means of optical communication by providing a photocell, an EEPROM, and an optical transceiver on the microchip. In such a case, the electrophoresis analyzer supplies the energy to the photocell on the microchip using an energy supplying light in order to operate the EEPROM and the optical communication apparatus using said energy. Access to the EEPROM is achieved as the optical transceiver on the microchip communicates with an optical transceiver on the electrophoresis analyzer. When said configuration is adopted, the connector are no longer needed, so that a trouble due to a poor connection can be eliminated. In addition, the microchip can be cleaned now. Furthermore, because the circuit on the microchip can be isolated electrically from the device, there is an advantage that malfunctioning due to noise can be reduced when an electrophoretic chip which is used under a strong electric field is involved.

[0015]

An application example of the present invention has been explained above. However, the present invention is not limited to the aforementioned application example, and it can be modified in a variety of manners without going beyond the range of the gist of the present invention described in the claims. For example, although transparent quartz was utilized for substrates 1 and 2, they only need to be transparent to the light used for the detector, and the material for substrates 1 and 2 can be selected according to the wavelength of the light used for the measurement. For example, Pyrex glass may be used where a visible light is involved, and UV ray transmitting glass, such as UV-2 by HOYA (K.K.) and #9741 by Corning, which shows high transmittivity up to the UV band may be used where a light in the ultraviolet band is used. In addition, the present invention can be applied not only to electrophoresis analyses but also to electrochromatographic analyzers and gas chromatographic analyzers.

[0016]

Effect of the invention

In the microchip for electrophoresis of the present invention, because the memory, such as the EEPROM, and the external connectors of the microchip are provided on the microchip, the attributes of the microchip, such as the type and the degree of crosslinking of the gel filled in the electrophoresis recesses of the microchip for electrophoresis and the type of the electrolyte serving as a migratory solution, and information on the history of its use can be stored in the memory mounted on the microchip, and said information can be transmitted to the electrophoresis analyzer on which it is used. As a result, the electrophoresis analyzer can identify

and select the microchip automatically, so that management mistakes, such as misidentification of a chip and a failure to renew the management information, can be eliminated. In addition, the service life of the microchip can now be judged properly. Furthermore, when the same microchip is to be used for multiple devices, because the management information travels with the microchip, it can be managed continuously and reliably. Furthermore, when radio communication is realized between the microchip and the analyzer, there is no more concern about a poor connection, and the microchip can be cleaned very easily.

Brief description of the figures

Figure 1 [A and B] are diagrams showing the outline configuration of the microchip for electrophoresis as an application example of the present invention.

Figure 2 are diagrams showing an example of the conventional microchip for electrophoresis.

Explanation of the symbols

1, 2	transparent quartz substrate
3, 4, 33, 34	capillary recess for migration
5, 6, 7, 8, 35	reservoir
9, 36	intersection
11, 12, 13, 14, 21, 22, 23	connector
20	EEPROM
31, 32	transparent substrate

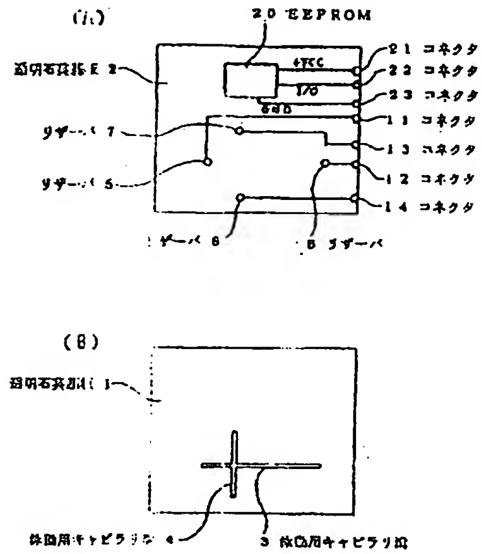

Figure 1 (A), (B)

Key: 1, 2 Transparent quartz substrate
3, 4 Capillary recess for migration
5, 6, 7, 8 Reservoir
11, 12, 13, 14, 21, 22, 23 Connector

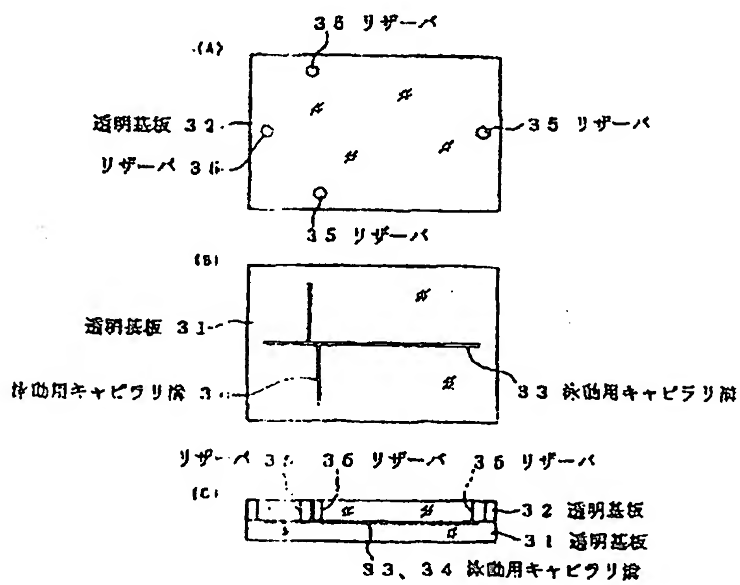

Figure 2 (A), (B), (C)

Key: 31, 32 Transparent substrate
33, 34 Capillary recess for migration
35 Reservoir